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EXAMINER

RUDE, TIMOTHY L

ART UNIT

PAPER NUMBER

2871

DATE MAILED: 04/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/739,478

Applicant(s)

SAKAMOTO ET AL.

Examiner

Timothy L Rude

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2871

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 and 13-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 22-37 is/are allowed.
- 6) ☒ Claim(s) 1-10, 13-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) Z.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claims

1. Claim 1 is amended, necessitating new grounds of rejection. Claims 11 and 12 are canceled.

Claim Objections

2. Claim 1 is objected to because of the following informalities: The recitation "fixes a boundary between two said pixels" is inconsistent with the Specification and the Drawings. For examination purposes, the recitation will be interpreted as -- fixes a boundary between two pixel regions --. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al (Yamada) USPAT 6,466,296 in view of Rho et al (Rho) USPAT 6,057,896.

[illegible]

Yamada does not explicitly disclose an active-matrix liquid crystal display comprising all of: a first substrate including a pixel electrode provided for each pixel, and a driving element provided for each of said pixel electrodes; a second substrate disposed opposite to said first substrate and including an opposite electrode; and a liquid crystal layer sandwiched between said first substrate and said second substrate, wherein said pixel electrode has a first recess in groove shape, formed therein which fixes a boundary between two pixel regions, wherein said pixel electrode is continuously formed across said recess, and a second recess for connecting the pixel electrode to the source electrode of an associated TFT.

Rho discloses in Figures 2 and 3, an active-matrix liquid crystal display comprising: a first substrate, 10, including a pixel electrode, 140, provided for each pixel, and a driving element, 20, provided for each of said pixel electrodes; a second substrate (col. 4, lines 19-23), disposed opposite to said first substrate and including an opposite electrode; and a liquid crystal layer (col. 4, lines 20-22), sandwiched between said first substrate and said second substrate, wherein said pixel electrode has a trench, 120 (Applicant's first recess in groove shape), formed therein which fixes a boundary between two pixel regions, wherein said pixel electrode is continuously formed across said recess, and a second recess, 130, for connecting the pixel electrode to the drain, 90 (Applicant's source) electrode of an associated TFT to comprise a display with reduced coupling capacitance generated between a data line and a pixel electrode and increase the aperture ratio of the liquid crystal display (col. 2, lines 8-20).

FIG.2

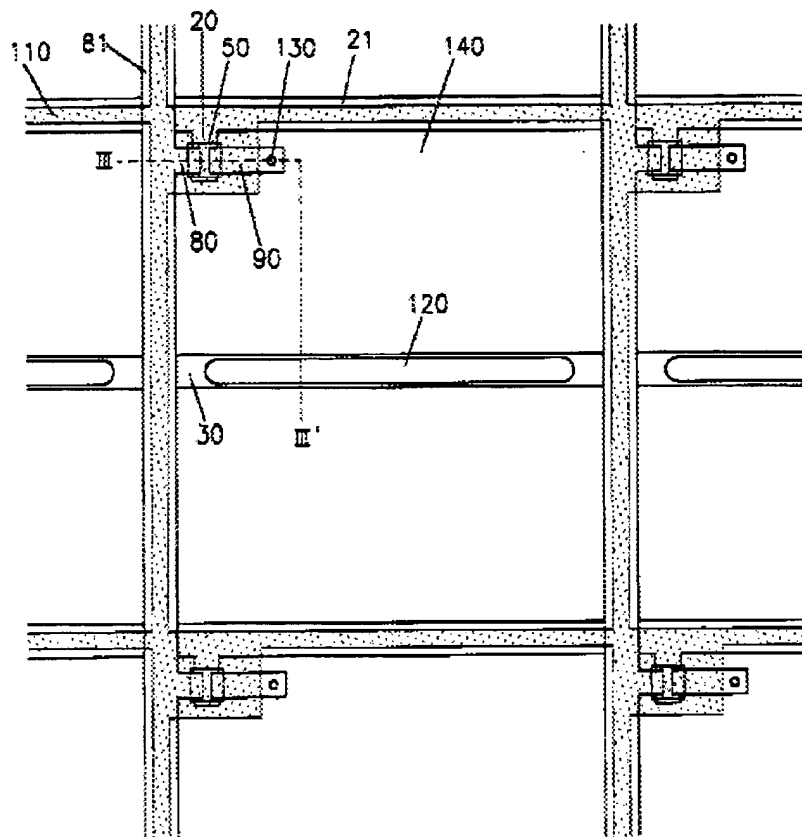
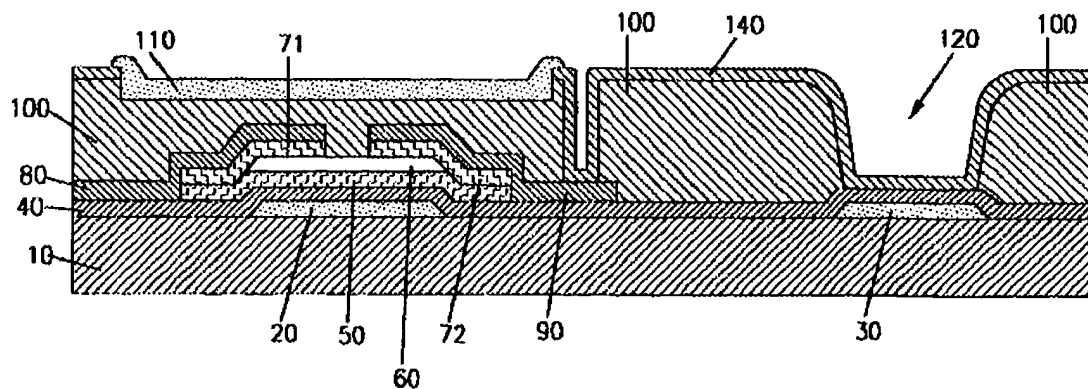


FIG.3



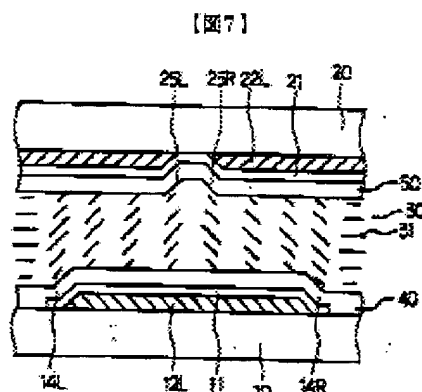
Rho is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add first and second recesses to comprise a display with reduced coupling capacitance generated between a data line and a pixel electrode and increase the aperture ratio of the liquid crystal display.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Yamada with the first and second recesses to comprise a display with reduced coupling capacitance generated between a data line and a pixel electrode and increase the aperture ratio of the liquid crystal display.

4. Claims 1, 2, 7-9, 18, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuo, Japanese Patent Abstract Publication, 07-311383, 28 November 1995, provided by Applicant, in view of Rho.

As to claim 1 Tokuo discloses in his 5th example (paras 0033 and 0034, and Drawings 7, 9, and 10), and 10th example (paras 0049-0051, which is a variant on the 7th example, paras 0040-0042), an active-matrix liquid crystal display (paras 0002-0004, description of prior art and background of the invention) comprising: a first substrate, 10, including a pixel electrode, 11, provided for each pixel, and a driving element (TFTs

in paras 0002-0004) provided for each of said pixel electrodes; a second substrate, 20, disposed opposite to said first substrate and including an opposite electrode, 21; and a liquid crystal layer, 30, sandwiched between said first substrate and said second substrate, wherein said pixel electrode has recesses with orientation control ramps, 25L, 25R, 14L, and 14R (Applicant's recess in groove shape / fixes a boundary between two pixel regions), formed therein.



Tokuo does not explicitly disclose a second recess in groove shape for connecting said pixel electrode to a source electrode of an associated TFT.

Rho teaches in Figures 2 and 3, an active-matrix liquid crystal display comprising: a pixel electrode, 140, connected to the drain electrode (Applicant's source electrode) through a contact hole, 130, in the passivation layer, 100, (Applicant's second recess in groove shape) to facilitate electrical connection of the pixel electrode to the TFT.

Rho is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add a second recess in groove shape to facilitate electrical connection of the pixel electrode to the TFT.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Tokuo with the second recess in groove shape of Rho to facilitate electrical connection of the pixel electrode to the TFT.

As to claim 2, Tokuo discloses in his 5th example (paras 0033 and 0034, and Drawings 9 and 10), and 10th example (paras 0049-0051, which is a variant on the 7th example, paras 0040-0042), an active-matrix liquid crystal display (paras 0002-0004, description of prior art and background of the invention) the display according to claim 1, wherein said pixel electrode has a generally rectangular shape (Drawing 10), and said recess is provided such that it extends from one of a pair of opposite sides of said pixel electrode to the other to divide said pixel electrode into two parts (Drawing 10).

As to claims 7 and 8, Tokuo discloses in his 5th example (paras 0033 and 0034, and Drawings 9 and 10), and 10th example (paras 0049-0051, which is a variant on the 7th example, paras 0040-0042), an active-matrix liquid crystal display (paras 0002-0004, description of prior art and background of the invention) the display according to claims 1 and 2, wherein the conductive layer of said pixel electrode is removed in said recess.

As to claim 9, Tokuo teaches in his 5th example (paras 0033 and 0034, and Drawings 9 and 10), and 10th example (paras 0049-0051, which is a variant on the 7th example, paras 0040-0042), an active-matrix liquid crystal display (paras 0002-0004,

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description of prior art and background of the invention) the display according to claim 2, wherein said recess is formed linearly with a constant width (Drawing 10).

As to claims 18 and 19, Tokuo discloses in his 10th example (paras 0049-0051, which is a variant on the 7th example, paras 0040-0042), an active-matrix liquid crystal display (paras 0002-0004, description of prior art and background of the invention) the display according to claims 1 and 2, wherein said liquid crystal layer comprises a liquid crystal material with negative dielectric constant anisotropy (para 0041), and liquid crystal molecules in said liquid crystal layer are aligned perpendicularly to each of said substrates (para 0041) when no voltage is applied between said pixel electrode and said opposite electrode.

5. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuo in view of Rho as applied to claims 1 and 2 above, and further in view of Shaver et al (Shaver) USPAT 4,370,194.

As to claims 3 and 4, Tokuo in view of Rho discloses the active-matrix liquid crystal display according to claims 1 and 2.

Tokuo in view of Rho does not explicitly disclose that when a voltage is applied between said pixel electrode and said opposite electrode, liquid crystal molecules in

said liquid crystal layer are laid toward a longitudinal direction of said recess in accordance with the magnitude of said voltage.

However, Tokuo in view of Rho discloses all the claimed structure, so the resultant liquid crystal molecules laid toward a longitudinal direction of said recess in the presence of an applied voltage would be achieved as indicated by Shaver.

Shaver teaches that the liquid crystal molecules can be line up in the direction of a groove in his Brief Summary of the Invention (col. 3, lines 17-29) to provide higher quality alignment than is available in prior art techniques. Shaver also teaches, although the particular relief structure discussed above is in the form of a grating (i.e., substantially parallel grooves), other configurations can be formed to align mesophases in accordance with arbitrary desired patterns.

Shaver is evidence that the combination of Tokuo in view of Rho would result in the claimed molecular alignment as does Applicant's enabling disclosure wherein no specific structural constraint not reflected by Tokuo in view of Rho is cited as a required structural constraint to obtained the claimed molecular alignment.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to comprise the claimed invention with the combination of Tokuo in view of Rho.

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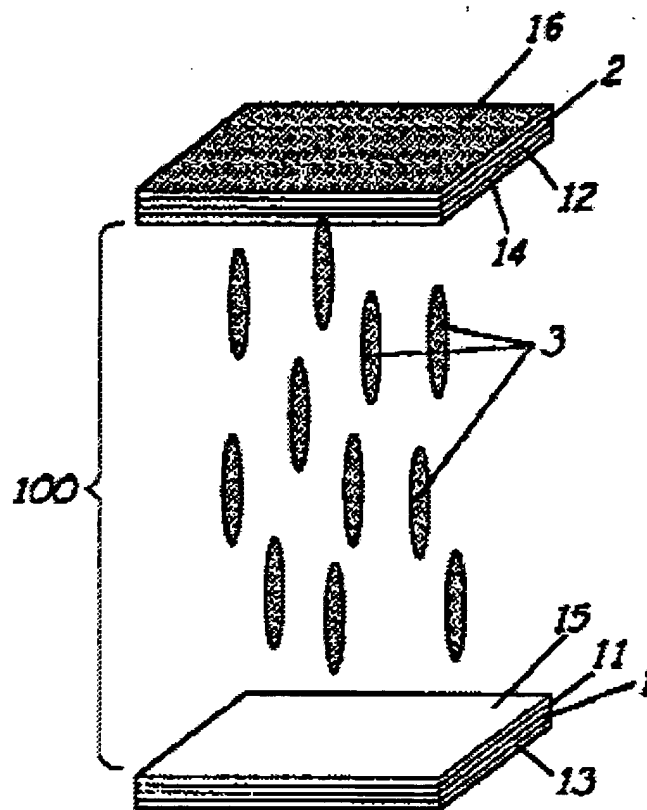
6. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuo in view of Rho, as applied to claims 1 and 2 above, and further in view of Lyu et al (LYU) USPAT 2002/0021400 A1.

As to claims 16 and 17, Tokuo in view of Rho discloses the active-matrix liquid crystal display according to claims 1 and 2.

Tokuo in view of Rho does not explicitly disclose displays further comprising: a polarizer; and at least one of an optically negative compensating film and an optically positive compensating film provided between said first substrate or said second substrate and said polarizer, whereby refractive index anisotropy in a layer including said liquid crystal layer and said compensating film is made isotropic.

Lyu teaches in Figure 1A (para 0020 through para 0024, and para 0079) displays further comprising: a polarizer, 10 and 11; and at least one of an optically negative compensating film, 30 (para 0080), and an optically positive compensating film, 20, provided between said first substrate or said second substrate and said polarizer, whereby refractive index anisotropy in a layer including said liquid crystal layer and said compensating film is made equal to or less than 15% of the retardation of the liquid crystal cell (Applicant's isotropic) (para 0023).

FIG.1A



Lyu is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add polarizers and compensating films to improve contrast and reduce retardation.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Tokuo in view of

Rho with the polarizers and compensating films of Lyu to improve contrast and reduce retardation.

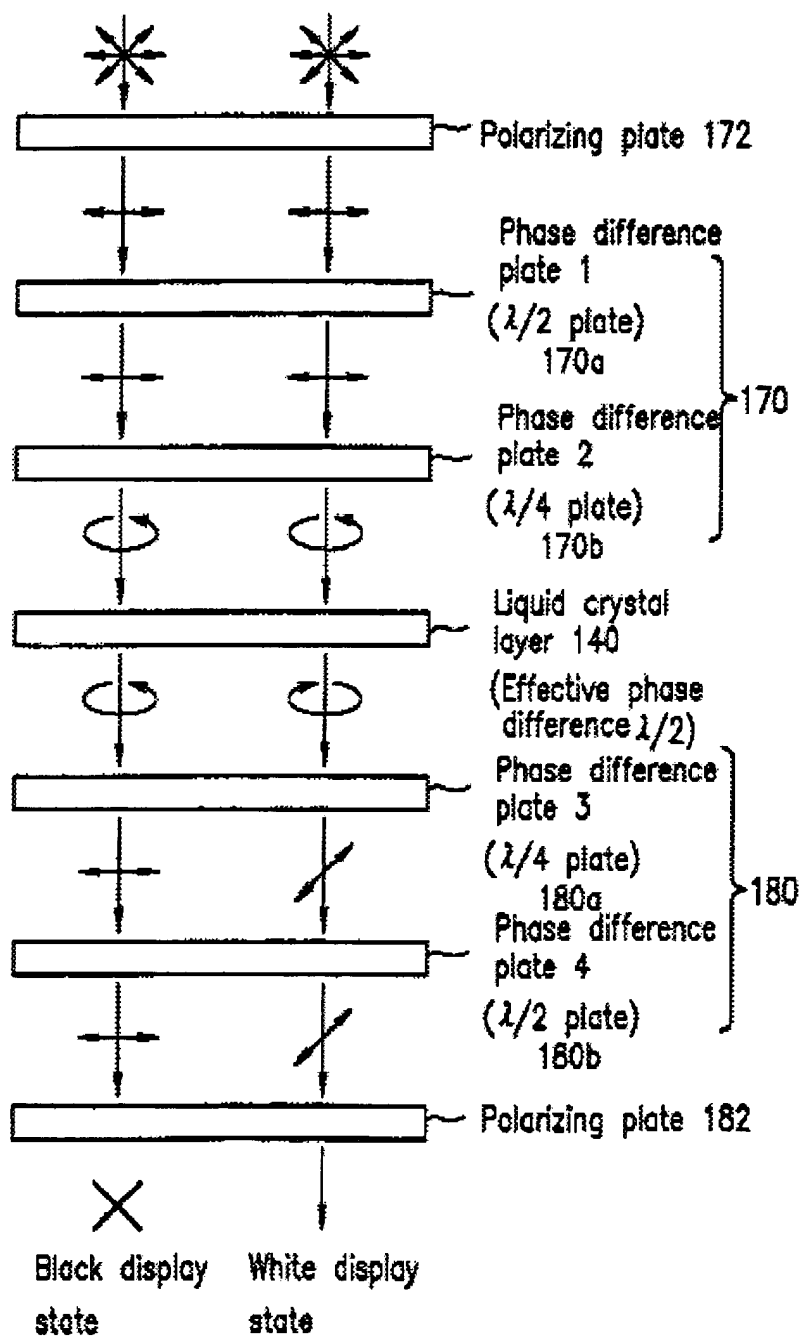
7. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuo in view of Rho as applied to claims 18 and 19 above, and further in view of Shimizu et al (Shimizu) USPAT 6,341,002 B1.

As to claims 20 and 21, Tokuo in view of Rho discloses the active-matrix liquid crystal display according to claims 18 and 19.

Tokuo in view of Rho does not explicitly disclose displays, further comprising quarter-wave plates provided on both sides of said liquid crystal layer, respectively, said quarter-wave plates having optical axis orthogonal to each other.

Shimizu teaches in Figure 4 (col. 8, lines 24-44), the use of quarter-wave plates, 170b and 180a, to convert linearly polarized light into circularly polarized light (col. 7, lines 18-64) and provide a darker black state for improved contrast (col. 9, lines 24-50).

FIG. 4



Shimizu is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add quarter-wave plates to convert linearly polarized light into circularly polarized light and improve contrast.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Tokuo in view of Rho with the quarter wave plates of Lyu to convert linearly polarized light into circularly polarized light and improve contrast.

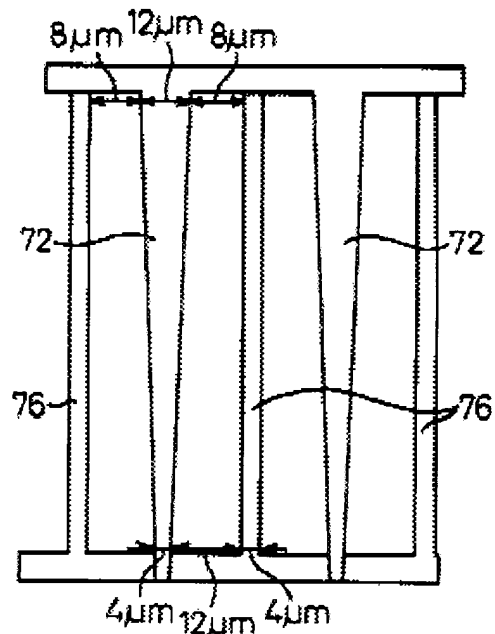
8. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuo in view of Rho as applied to claim 2 above, and further in view of Yoshida et al (Yoshida) USPAT 6,222,599 B1.

As to claim 10, Tokuo in view of Rho discloses the active-matrix liquid crystal display according to claim 2.

Tokuo in view of Rho does not explicitly disclose displays, wherein said recess is formed in said pixel electrode in tapered shape such that it has a smaller width at one of a pair of opposite sides of said pixel electrode and has a larger width at the other.

Yoshida teaches in Figure 37 a recess formed in said pixel electrode in tapered shape such that it has a smaller width at one of a pair of opposite sides of said pixel electrode and has a larger width at the other, to provide a broader voltage transmittance characteristic curve (col. 14, lines 27-32).

Fig. 37



Yoshida is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add a recess formed in said pixel electrode in tapered shape such that it has a smaller width at one of a pair of opposite sides of said pixel electrode and has a larger width at the other, to provide a broader voltage transmittance characteristic curve.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Tokuo in view of Rho with the recess formed in said pixel electrode in tapered shape of Yoshida to provide a broader voltage transmittance characteristic curve.

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9. Claims 2, 6, 9, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rho as applied to claim 1 above, and further in view of Tokuo.

As to claim 2, Rho discloses the active-matrix liquid crystal display according to claim 1, wherein said pixel electrode has a generally rectangular shape (Figure 2).

Rho does not explicitly disclose a display, wherein said recess is provided such that it extends from one of a pair of opposite sides of said pixel electrode to the other to completely divide said pixel electrode into two parts.

Tokuo teaches in his 5th example (paras 0033 and 0034, and Drawings 9 and 10) a recess provided such that it extends from one of a pair of opposite sides of said pixel electrode to the other to divide said pixel electrode into two parts, to provide a split means to improve viewing angle (para 0034).

Tokuo is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add a recess provided such that it extends from one of a pair of opposite sides of said pixel electrode to the other to divide said pixel electrode into two parts, to provide a split means to improve viewing angle.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Rho with the recess of Tokuo.

As to claim 6, Rho discloses a pixel electrode that is continuously formed across said recess (Figure 3).

As to claim 9, Rho discloses a recess that is formed linearly with a constant width (Figure 2). Tokuo also discloses a recess that is formed linearly with a constant width (Drawing 10).

As to claim 14, Rho discloses in Figure 3 an active-matrix liquid crystal display wherein said recess, 120, is generally rectangular (somewhat reversed trapezoidal) in cross section. As illustrated, the angle formed between a surface of said pixel electrode other than its portion corresponding to said recess and a side surface of said recess is much larger than 60 degrees and a little less than 90 degrees (falls well within Applicant's equal to or larger than 60 degrees and less than 90 degrees) as is expected due to forming the trench by common etching techniques (col. 6, lines 3-9).

10. Claims 1 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (APA) in view of Hirata et al (Hirata) USPAT 6,141,077.

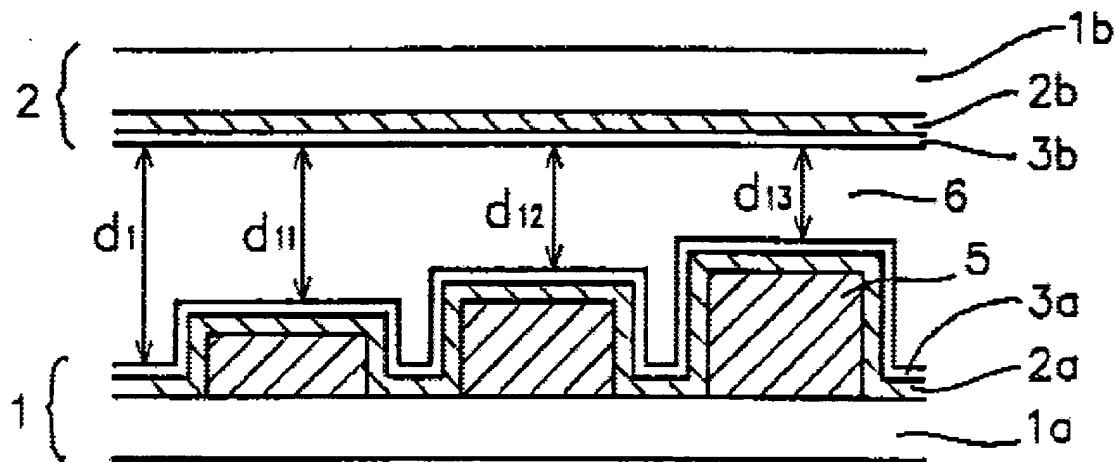
As to claims 1 and 5, APA discloses in Figures 1-3, an active-matrix liquid crystal display comprising: a first substrate, 86, including a pixel electrode, 88, provided for each pixel, and a driving element, 87, provided for each of said pixel electrodes; a second substrate, 91, disposed opposite to said first substrate and including an

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opposite electrode, 93; and a liquid crystal layer, 83, sandwiched between said first substrate and said second substrate.

APA does not explicitly disclose a pixel electrode that has a recess in groove shape formed therein.

Hirata discloses in Figure 7 (col. 9, line 65, through col. 10, line 48) a pixel electrode, 2a, that has multiple recesses in groove shape formed therein which separate regions of differing electrode height, wherein said pixel electrode is continuously formed across said recesses, to achieve a combined V-T curve effect resulting in good viewing angle characteristics, free from an inversion phenomenon (col. 10, lines 36-48).

FIG. 7

Hirata is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add electrode regions of differing height separated

by recess grooves to achieve a combined V-T curve effect resulting in good viewing angle characteristics, free from an inversion phenomenon.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of APA with the groove(s) of Hirata to achieve a combined V-T curve effect resulting in good viewing angle characteristics, free from an inversion phenomenon.

11. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rho as applied to claim 1 above.

As to claim 3, Rho discloses the active-matrix liquid crystal display according to claim 1.

Rho does not explicitly disclose that when a voltage is applied between said pixel electrode and said opposite electrode, liquid crystal molecules in said liquid crystal layer are laid toward a longitudinal direction of said recess in accordance with the magnitude of said voltage.

However, Rho discloses all the claimed structure, so the resultant liquid crystal molecules laid toward a longitudinal direction of said recess in the presence of an applied voltage would be inherent.

12. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuo as applied to claims 1 and 2 above, in view of APA.

As to claim 13, Tokuo discloses the active-matrix liquid crystal display according to claim 2.

Tokuo does not explicitly disclose a guide in bank shape formed on said first substrate along a side of said pixel electrode in parallel with a longitudinal direction of said recess.

APA discloses in Figures 1 and 2, a guide in bank shape, 89, formed on said first substrate along a side of said pixel electrode in parallel with a longitudinal direction of an opposed guide, 94, to stabilize the dividing position of the display.

APA is evidence that ordinary workers in the art of liquid crystals would find the reason, suggestion, or motivation to add a guide in bank shape formed on said first substrate along a side of said pixel electrode in parallel with a longitudinal direction of an opposed guide or said recess to stabilize the dividing position of the display.

Therefore, it would have been obvious to one having ordinary skill in the art of liquid crystals at the time the invention was made to modify the LCD of Tokuo with the a guide in bank shape formed on said first substrate along a side of said pixel electrode in parallel with a longitudinal direction of said recess of APA.

Response to Arguments

13. Applicant's arguments with respect to claims 1-21 have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

14. Claims 22-37 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

As to claim 22, a search of relevant prior art did not disclose, alone or in combination, the active-matrix liquid crystal display as claimed, wherein said recess is formed linearly *with a constant width except that it has a smaller width in its central portion in a longitudinal direction*. The closest reference is Rho, but Rho does not disclose the claimed structure.

As to claim 30, a search of relevant prior art did not disclose, alone or in combination, the active-matrix liquid crystal display as claimed, wherein said recess is formed such that its *width is smaller in its central portion in a longitudinal direction of said recess and becomes gradually larger toward each of a pair of opposite sides of said pixel electrode*. The closest reference is Rho, but Rho does not disclose the claimed structure.

As to claims 23-29 and 31-37, they are dependant upon claims with allowable subject matter above.

15. Claims 11 and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

As to claim 11, a search of relevant prior art did not disclose, alone or in combination, the active-matrix liquid crystal display according to claim 2, wherein said recess is formed linearly *with a constant width except that it has a smaller width in its central portion in a longitudinal direction*. The closest reference is Rho, but Rho does not disclose the claimed structure.

As to claim 12, a search of relevant prior art did not disclose, alone or in combination, the active-matrix liquid crystal display according to claim 2, wherein said recess is formed such that its *width is smaller in its central portion in a longitudinal direction of said recess and becomes gradually larger toward each of a pair of opposite sides* of said pixel electrode. The closest reference is Rho, but Rho does not disclose the claimed structure.

Conclusion

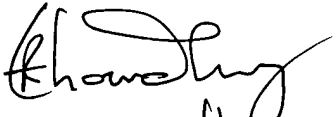
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy L Rude whose telephone number is (703) 305-0418. The examiner can normally be reached on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert H Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4900.

Timothy L Rude
Examiner
Art Unit 2871

TLR
April 1, 2003


T. Choudhury
Primary Examiner